

AD-A086 900

NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON

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NATIONAL DAM SAFETY PROGRAM. UPPER AETNA LAKE DAM (NJ 00420), D--ETC(U)

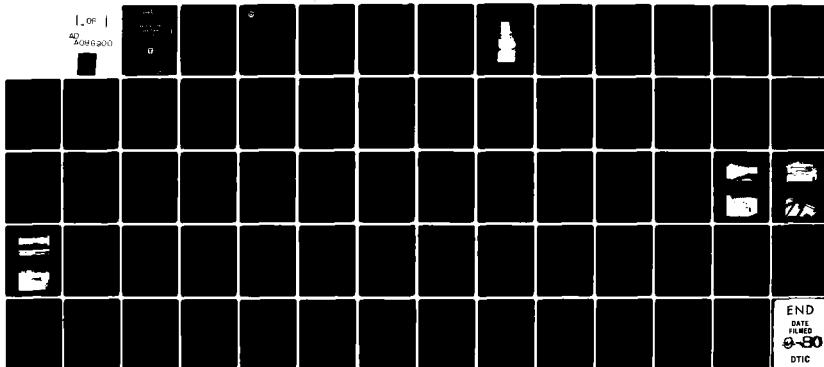
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LEVEL

DELAWARE RIVER BASIN
SHARPS BRANCH OF HAYNES CREEK
BURLINGTON COUNTY
NEW JERSEY

**UPPER AETNA
LAKE DAM
NJ 00420**

**PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM**



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DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

FEBRUARY 1980

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.		



IN REPLY REFER TO

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
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PHILADELPHIA, PENNSYLVANIA 19106

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

15 JUL 1980

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Upper Aetna Lake Dam in Burlington County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Upper Aetna Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to six percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is the One Hundred Year Flood.) To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report, the following remedial actions should be initiated:

(1) Embankment areas in back of the wingwalls should be regraded and covered with slope protection, and other minor erosion of slopes regraded and seeded or sodded as necessary.

(2) Conduct an examination of the overall spillway structure with a view to planning the repair or replacement of selected timbers before their condition becomes critical.

c. Within one year from the date of approval of this report, the owners should develop written procedures and a periodic maintenance plan to ensure the safety of the dam.

NAPEN-N

Honorable Brendan T. Byrne

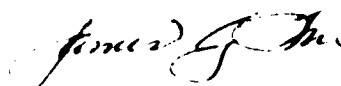
d. The owner should develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Forsythe of the Sixth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,



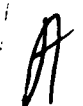
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
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Division of Water Resources
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P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
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UPPER AETNA LAKE DAM (NJ00420)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 12 November 1979 by Louis Berger and Associates, Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Upper Aetna Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to six percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is the One Hundred Year Flood.) To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report, the following remedial actions should be initiated:

(1) Embankment areas in back of the wingwalls should be regraded and covered with slope protection, and other minor erosion of slopes regraded and seeded or sodded as necessary.

(2) Conduct an examination of the overall spillway structure with a view to planning the repair or replacement of selected timbers before their condition becomes critical.

c. Within one year from the date of approval of this report, the owners should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

d. The owner should develop an emergency action plan together with an effective warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

APPROVED: *James G. Ton*

JAMES G. TON

Colonel, Corps of Engineers
District Engineer

DATE: *20 Jan 80*

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM


Name of Dam: Upper Aetna Lake Dam Fed ID# NJ00420,
NJ ID# 413 (31-55)

State Located New Jersey
County Located Burlington
Coordinates Lat. 3951.4 - Long. 7448.9
Date of Inspection 12 November 1979

ASSESSMENT OF
GENERAL CONDITIONS

Upper Aetna Lake Dam is assessed to be in a fair overall condition and is recommended to be downgraded to a significant hazard category. Overtopping would not exacerbate the danger to downstream property or human life and no detrimental findings were uncovered to question the structural stability. Remedial actions to be undertaken in the future consist only of regrading and seeding the minor erosion on the embankment sideslopes.

The dam has an inadequate spillway capacity, being able to accommodate only 5% of the 100 year design flood. Further hydraulic studies are recommended.



Rudolph Wrubel
Vice President
Louis Berger & Associates, Inc.



OVERVIEW OF UPPER AETNA LAKE DAM

November, 1979

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM: UPPER AETNA LAKE DAM FED #NJ00413

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with Contract FPM-36 between Louis Berger & Associates, Inc. and the State of New Jersey and its Department of Environmental Protection, Division of Water Resources. The State, in turn, is under agreement with the U.S. Army Engineer District, Philadelphia to have this inspection performed.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the Upper Aetna Dam and appurtenant structures, and to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

Upper Aetna Lake Dam is a 32-year old earth roadway embankment approximately 230 feet long with a timber box spillway and bridge located about 60' from the west abutment. The embankment carries the asphalt paved two-lane Beech Drive across the dam structure. The three-sided timber box spillway is affixed to the upstream face of the pile supported one-span timber bridge and has a total crest length of 35.67 feet with one set of removable flashboards 3'-4" wide. The bridge consists of a single 16'-0" span of timber stringers, deck planking and railings.

b. Location

Upper Aetna Lake Dam is located 3.6 miles southwest of the intersection of Route 70 and

Route 206 in the Borough of Medford Lakes, Burlington County, and is built across Sharps Branch of Haynes Creek. The dam is about 0.7 mile southeast of the intersection of Stokes and Tabernacle Roads and is one of a series of small structures located within the community.

c. Size Classification

The maximum height of the dam is 14 feet at the bridge structure and the maximum pool storage is estimated to be 58 acre-feet. Therefore, the dam is placed in the small size category as defined by the Recommended Guidelines for Safety Inspection of Dams (storage less than 1,000 acre-feet and height less than 25 feet).

d. Hazard Classification

Based on Corps of Engineers criteria and the fact that a failure of Upper Aetna Lake Dam should not cause excessive damage to downstream property, the classification is recommended to be downgraded to significant hazard, the same as Lower Aetna Lake. The total capacity is such that an abrupt failure should not unduly tax the Lower Aetna Lake basin nor seriously inundate its surrounding homes. Greater damage could result in the event of failure of one or more upstream dams but only asynchronous failure is considered herein.

e. Ownership

Information from community sources indicate the timber box spillway and embankment are owned and maintained by the Medford Lakes Colony Club, Administration Building, Medford Lakes, New Jersey 08055. The bridge (Identification No. D5.144), is owned and maintained by Burlington County; hence it appears that there is joint legal ownership.

f. Purpose of Dam

The dam was built to impound a recreational lake within a lakeside residential development.

g. Design and Construction History

The dam in its present configuration was constructed in 1946 along the alignment of an existing roadway embankment and timber bridge. The

timber bridge and spillway structural drawings were prepared and filed with the N.J. Water Policy Commission by F.L. Branin, Consulting Engineer of Burlington County, in conjunction with Highway Bridge Encroachment Application No. 1386. No other pertinent historical facts were located regarding the earlier bridge and embankment but it is believed the dam was initially constructed in the late 1920's when the residential development was started in the community.

h. Normal Operating Procedures

Flashboards are adjusted manually by maintenance personnel as necessary. There are no other operational devices (see Section 4).

1.3 PERTINENT DATA

a. Drainage Area

Upper Aetna Lake has a drainage area of 5.51 square miles which consists mainly of woodland and some residential development.

b. Spillway capacity (crest at top of dam) - 282 cfs

c. Elevation (ft. above MSL)

Top of dam - + 66.9
Recreational pool - +65 (top of spillway crest)
Streambed at centerline of dam - +53.1

d. Reservoir

Length of maximum pool - 2600 feet
Length of recreation pool - 2500 feet

e. Storage (acre-feet)

Maximum pool (top of dam) - 58
Recreation pool (spillway crest) - 37

f. Reservoir Surface (acres)

Maximum pool - 36.1
Recreation pool - 23.1

g. Dam

Type - Earth roadway embankment with bridged spillway structure.

Length - 230_± feet

Height - 14 feet

Top width - 26_± feet

Side slopes - 3H:1V to 1H:1V

Zoning - unknown

h. Diversion and Regulating Tunnel - none

i. Spillway

Type - Three sided timber box drop inlet
(effective length - 32')

Crest elevation - +65

Gates - none

U/S channel - main lake reservoir

D/S channel - Lower Aetna Lake

j. Regulating Outlets - 3'-4" flashboards built into
spillway

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The only information available for review consisted of four drawings prepared by F.L. Branin, Burlington County Engineer, under the general title "Plans for Reconstruction of Beech Drive Bridge No. D5.144, Medford Lakes Borough" dated February, 1946. No design computations or structural analyses were included, and a search of the N.J. Division of Water Resources records revealed nothing further of a technical nature. The embankment appears to have been in place before 1946 and the bridge construction replaced an earlier structure at the same site.

2.2 CONSTRUCTION

Construction of the bridge/spillway was inspected by Division of Water Resources engineers in progress and after completion was approved by the State. No information was available regarding road construction or reconstruction, but the lack of differential settlement makes it appear that the embankment is well compacted. Foundation soils of this vicinity are recent alluvium composed of sand, silt, some clay and surficial organic matter over deeper lying sand formations. The lake is situated along an undulating interstream divide characteristic of the central part of Burlington County and lies within a narrow strip of land covered with recent alluvium of mainly silt and sand, with some clay and significant amounts of organic matter near the surface. Underlying the alluvium, and existing as surficial soil beyond the stream divide, is the Kirkwood Sand formation, a fine micaceous quartz sand with interbedded silty sand layers. Drainage conditions within the immediate area are poor. Depth to bedrock is greater than 100 feet.

2.3 OPERATION

There are no records of construction modifications and the present structure is essentially as reconstructed in 1947. The dam underwent a general inspection in 1970 with no record of any changes or problems. The spillway can function uncontrolled, but manual shifting of flashboards is commonly used during periods of heavy flow and to make desired alterations in the lake level.

2.4 EVALUATION

a. Availability

It is believed that sufficient engineering data is available to conduct the following assessment of overall structural stability and safety.

b. Adequacy

The original engineering data reviewed indicates that the structure was carefully designed, and was built in accordance with the design plans. Since the work was periodically inspected by representatives of the State Water Policy Commission, it is believed that it was carried out in a proper manner. Information available is therefore considered adequate for the following assessment.

c. Validity

The validity of the available design plans is not questioned, and based on field observation the data appears correct regarding the dam's existing configuration.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspection of the dam was conducted on 12 November, 1979 with a subsequent inspection held on December 27, 1979. The water level at the time of the initial inspection was low, the lake having been partially drained for cleaning and in the process of gradually being refilled. New flashboards were being placed. Both reservoirs and the spillway were clear of debris.

b. Dam

In general, the dam was found to be in a satisfactorily stable condition and there was no evidence of recent overtopping. The reservoir water level appears to be fairly constant during most periods, except during heavy rains or dewatering for maintenance operations. The embankment is well compacted and there is no evidence of seepage, although the downstream toe is completely submerged by Lower Aetna Lake headwaters. Slopes are moderate, ranging from 3H:1V at the left end to the 1H:1V of the original design found elsewhere. All slopes are well covered with grass down to the normal water line, and are free of trees or brush of any consequence. Some erosion exists behind the wingwalls in spite of maintenance efforts to stabilize the surface with asphalt. Signs of settlement from the attitude of guardrails and utility poles is relatively minor and inconclusive. There is evidence of relatively minor repairs to the roadway pavement, including patching at the edges near the crest of the slopes, but no more than expected for a well-traveled local street. Culverts at each end of the embankment help control the surface runoff effectively, and some recent excavation was noted near their outlets to rid the lake bottom of a local accumulation of silt.

c. Appurtenant Structure

The three-sided timber box spillway which measures approximately 16' x 10' is in reasonably good condition except for some deterioration of

individual posts and planks. The entire structure is solidly constructed of heavy, creosoted wood members and is equally solidly founded on a substantial pattern of timber piles. Horizontal and vertical alignment is true throughout. Bridge deck planking is in satisfactory condition as is the remainder of the spillway outlet. The structure is clean and the flashboards of the intake seem to be kept in good working order. No designed auxiliary spillway exists, except for a relative low point in the paved roadway near the west end of the embankment. Excess flows can be carried across the embankment here in an emergency, and a small paved outlet is provided on the downstream slope. There is evidence of asphalt patching on the crest roadway surface and minor ravelling at the edges but the overall condition is satisfactory.

d. Reservoir Area

Upper Aetna Lake has a stable, well-defined shoreline consisting of an almost continuous series of bulkheads which front the lakeside properties. Development along both banks is extensive and each property usually has its own dock. Elevation of docks and bulkheads averages only about 2 feet above normal water levels and many of the homes are only 2 to 3 feet higher.

e. Downstream Channel

Upper Aetna Lake empties directly into Lower Aetna Lake with no intervening stream. Both lakes contain clear water and are free of obstructions. There is no indication of either silting of the upstream channel nor of scouring or undercutting below the spillway. At the time of inspection the differential in water elevation was less than 3 feet between the two lakes due to the temporary low level of the upper lake.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Operational procedures were not observed by the inspection team. Employees of the Medford Lakes Colony Club are responsible for routine and emergency manual operations of spillway flashboards for this as well as for Lower Aetna Lake Dam. They also coordinate these operations with all other lakes that are part of the same chain of lakes within the community

4.2 MAINTENANCE OF DAM

Maintenance of the embankment and spillway structure is also carried out by Medford Lakes Colony Club personnel. There is no evidence of any recent repairs to the structure. Maintenance of the bridge is the responsibility of Burlington County but no records were located regarding recent inspections.

4.3 MAINTENANCE OF OPERATING FACILITIES

Replacing flashboards and keeping them functional is also done by the Colony Club personnel, as well as clearing the spillway of debris. There are no other operating facilities.

4.4 DESCRIPTION OF WARNING SYSTEM IN EFFECT

Notification of unusual circumstances is by unwritten, mutual accord between the community and the responsible parties of the other lakes both downstream and upstream.

4.5 EVALUATION OF OPERATIONAL ADEQUACY

The present operational procedures and safeguards have been effective since the 1947 construction of the dam. No overtopping or damage was reported in the 1970 Inspection Report and no problem areas were revealed by present employees of the Colony Club. Similar to the other dams along this stream, the only serious threat would require an almost simultaneous failure of upstream dams. Therefore the present operations are considered adequate in view of the hazard classification and physical restraints of the site.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

In accordance with the criteria in the Recommended Guidelines for Safety Inspection of Dams, it has been determined that the dam at Aetna Lake is small in size and of significant hazard. Accordingly, a 100-year frequency event was selected as the design storm and an inflow hydrograph was calculated using precipitation data from Technical Paper 40 and NOAA Technical Memorandum NWS Hydro-35. The routed outflows from Upper Stokes and Lake Stockwell dams were included in the inflow to Upper Aetna Lake as these dams lie immediately upstream and are completely within the overall drainage basin of the study dam. Inflow was also included due to the intermediate drainage area between Upper Aetna and Lake Stockwell dams. The total inflow to the reservoir for the selected 100-year storm was computed utilizing the HEC-1 computer program. This gave a peak inflow to the reservoir of 5678 cfs and routing reduced the peak to 5216 cfs. The maximum spillway discharge capacity is approximately 282 cfs before overtopping occurs and thus can accommodate only 5% of the design flood.

b. Experience Data

The dam was originally designed to accommodate a storm with a peak discharge of 286 cfs and for this flow, the spillway is marginally adequate. There are no records of the dam having ever been overtopped in the past and it appears that any minor overtopping in the past merely closed the roadway for a brief period and would do little damage, except possibly to the downstream slopes below the low point in the roadway crest. There are no streamflow records available.

c. Visual Observations

The lake level was approximately 4 feet below normal pool at the time of inspection. The lake had been lowered to facilitate maintenance of lakeside docks and thus did not provide a visual view of normal low-flow conditions.

d. Overtopping Potential

Based on the results of the hydraulic analysis, the capacity of the spillway is inadequate to accommodate the 100-year frequency storm and thus, the potential remains substantial. Although there is no evidence that the dam has been overtopped, the design storm would overtop the crest by about 3.5 feet.

e. Drawdown

It would take approximately 6 hours to dewater Upper Aetna Lake by removing the stoplogs to the bottom of the spillway (El. 53.1).

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Based upon the visual inspection, all elements of the Upper Aetna Lake Dam are felt to be in a moderately sound structural condition. The width to height ratio of the embankment is satisfactory as is the apparent compaction, angle and condition of side slopes. The timber structure is presently serviceable but will require attention with further passage of time as several members exhibit some dryrot and structural deterioration.

b. Design and Construction Data

The review of the available design plans for the timber spillway indicates that it was conservatively designed. The entire structure is founded on timber piling and has performed satisfactorily since its completion. Design computations and detailed construction data were not available, but no problems have been recorded for either the spillway or the embankment.

c. Operating Records

No records are available, but manual operations and maintaining of unimpeded flow are handled by the full-time employees of the Colony Club.

d. Post Construction Changes

None are recorded.

e. Seismic Stability

Upper Aetna Lake Dam is located in Seismic Zone 1, and due to embankment width versus low height it has negligible potential earthquake vulnerability. Experience indicates that dams with adequate stability under static loads will have adequate stability under dynamic loading intensities.

SECTION 7 - ASSESSMENTS/RECOMMENDATIONS/
PROPOSED REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Subject to the inherent limitations of the Phase I visual inspection, the Upper Aetna Lake Dam is classified as being in fair but satisfactory condition although the spillway is incapable of passing the design flood. The dam embankment was built of material of unknown composition but due to its width to height ratio it is believed to be of a sufficiently impervious condition to withstand normal hydraulic heads. The present spillway does not meet the requirements of the Recommended Guidelines for Safety Inspection of Dams, being able to accommodate only 5% of the design flood as determined by Corps of Engineers criteria. The calculated SDF would overtop the dam in the roadway portion by approximately 3.5 feet at the low points along the crest, but outside of probable erosion of the downstream face it is felt that little other damage would occur.

b. Adequacy of Information

The information gathered for the Phase I inspection is deemed to be adequate regarding the structural stability of the dam and its effect upon the overall safety.

c. Urgency

It is recommended that the remedial measures enumerated below be taken under advisement in the future.

d. Necessity for Further Study

Due to the hazard classification and the fact that this dam is an intermediate structure in a chain of seven dams along this water course, further hydraulic studies are recommended in conjunction with the several upstream and downstream dams. These studies should take into account the full reach of Sharps Branch and the hydraulic interface between dams.

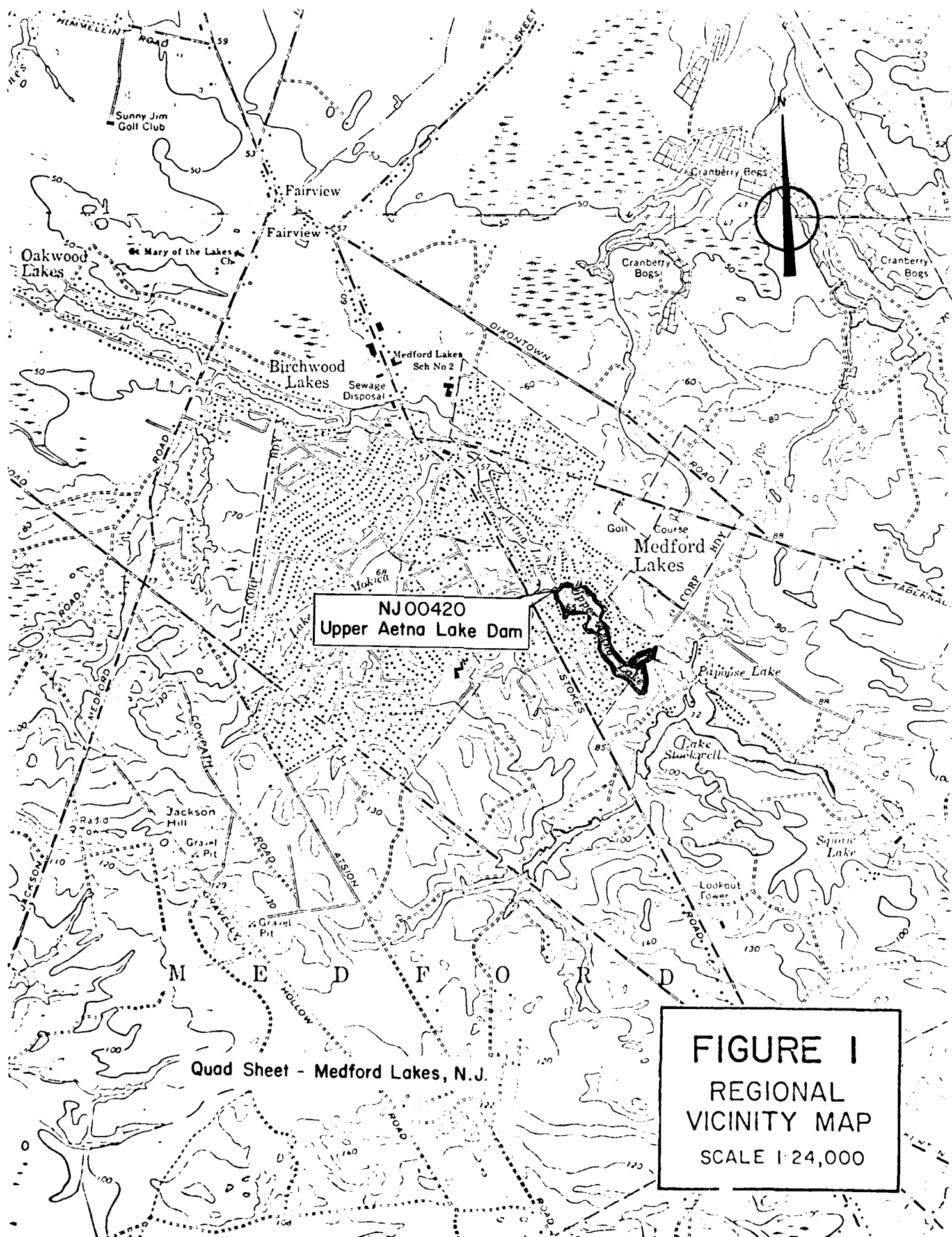
7.2 RECOMMENDATIONS/REMEDIAL MEASURES

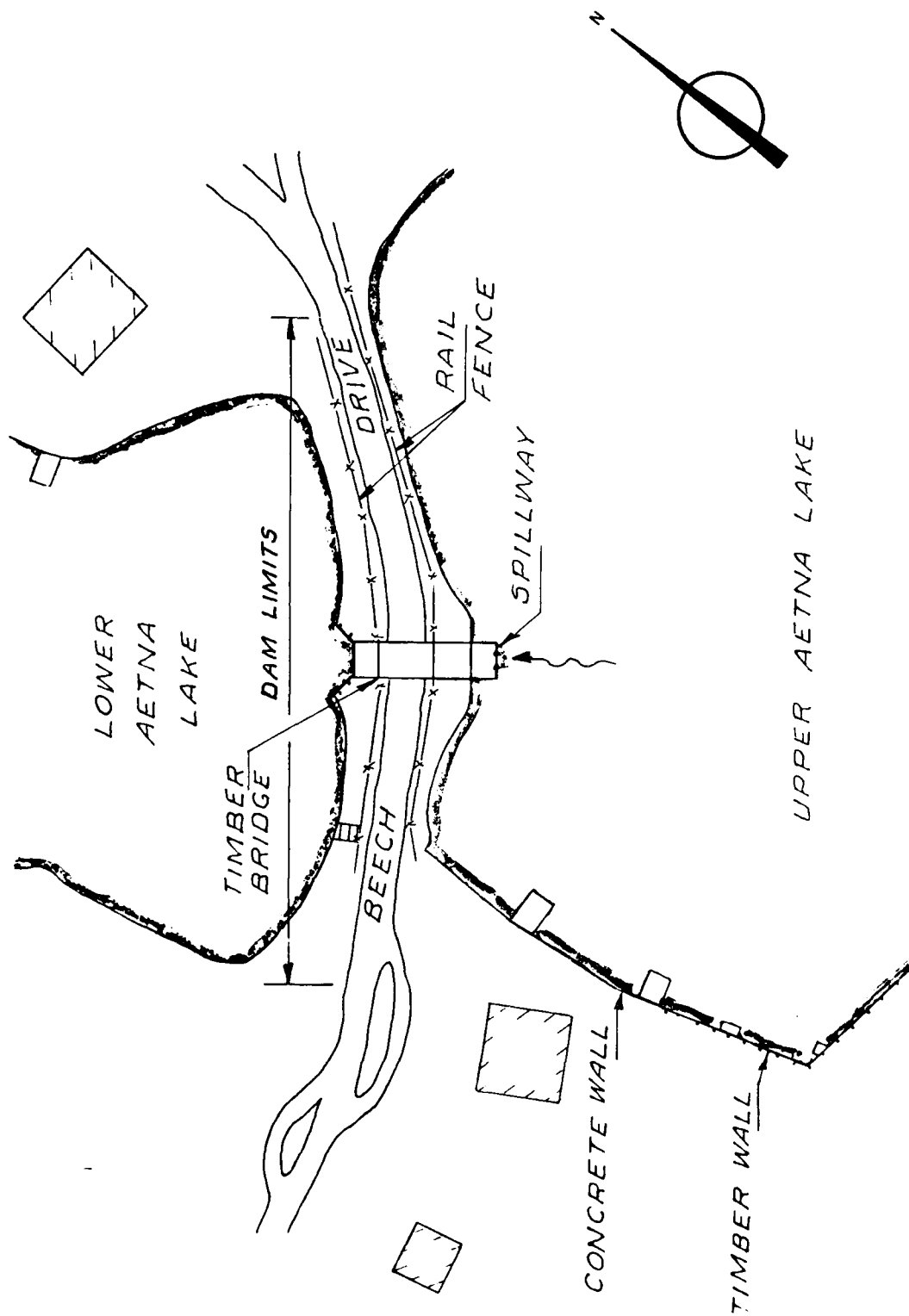
a. Recommended Actions

On the basis of this visual inspection, improvements to the present spillway are not warranted until further hydraulic studies are completed. Embankment areas in back of wingwalls should be regraded and covered with slope protection, and other minor erosion of slopes regraded and seeded or sodded as necessary. Other remedial measures to be taken under advisement and consideration include the examination of the overall spillway structure with a view to planning the repair or replacement of selected timbers before their condition becomes critical.

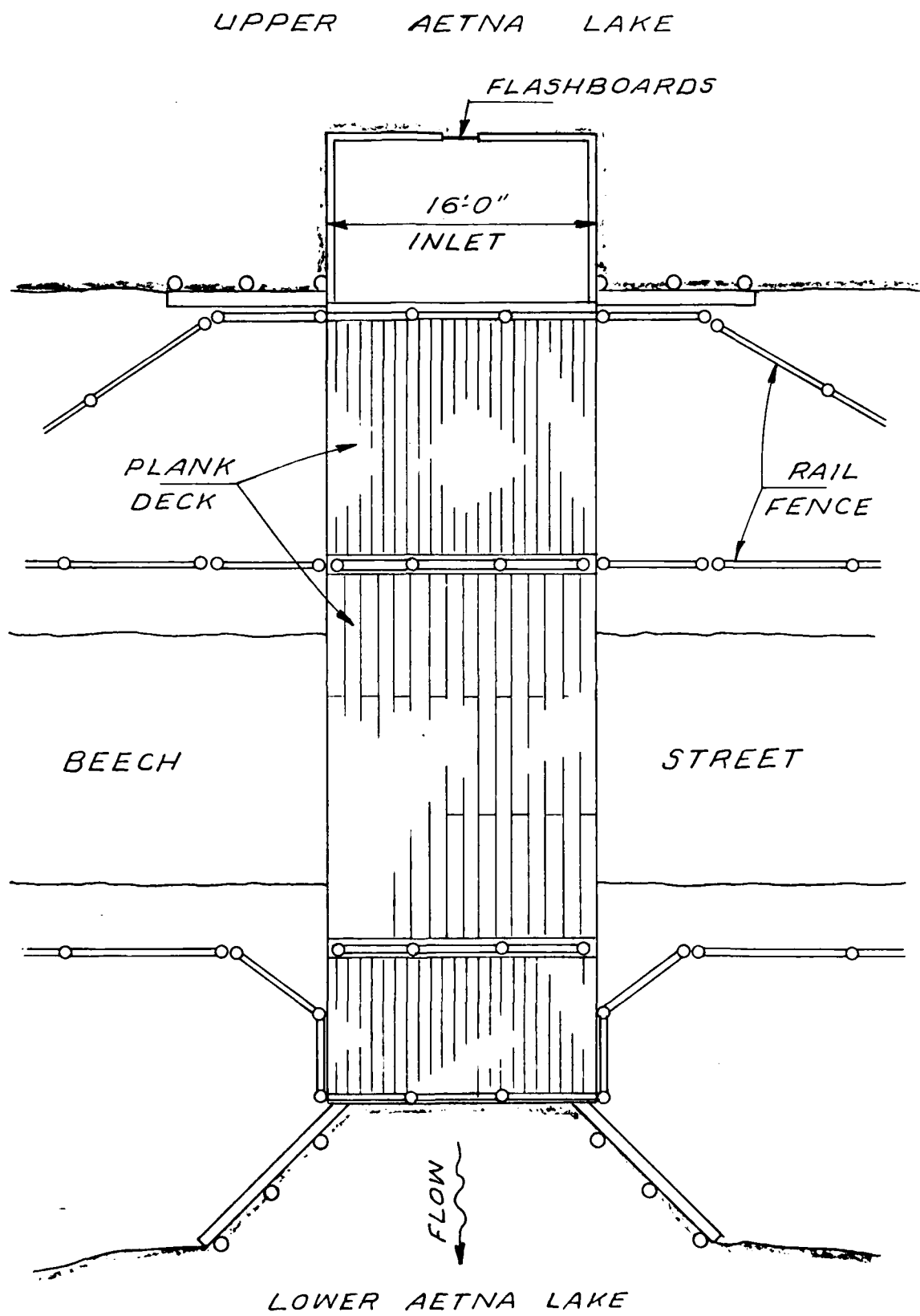
b. O&M Maintenance and Procedures

In the near future the owner should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam.





PLAN OF DAM
NOT TO SCALE



PLAN

FIGURE 3

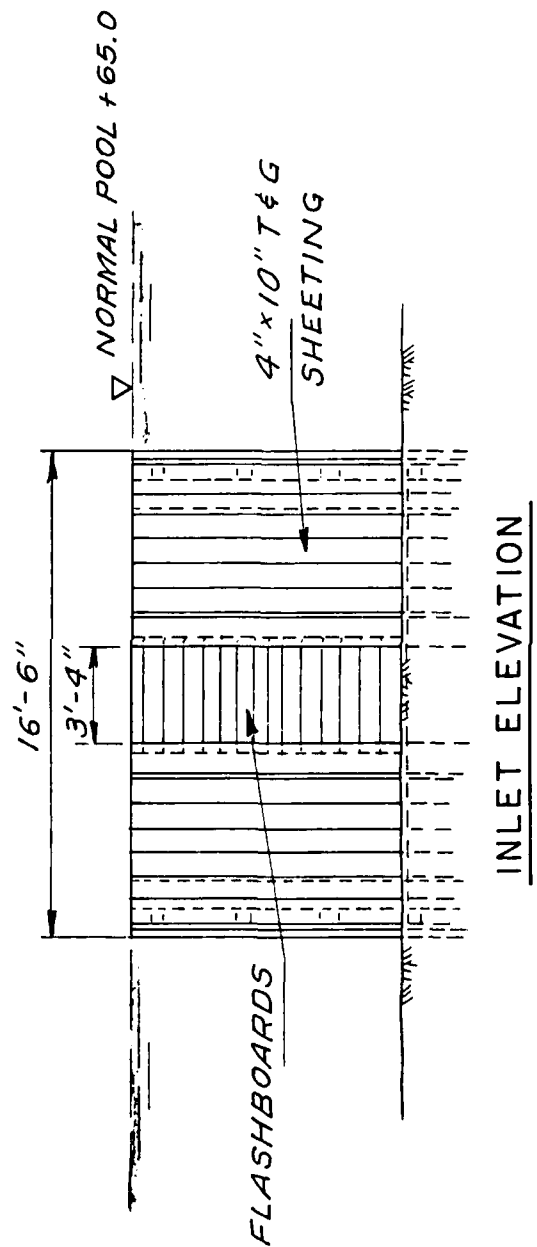
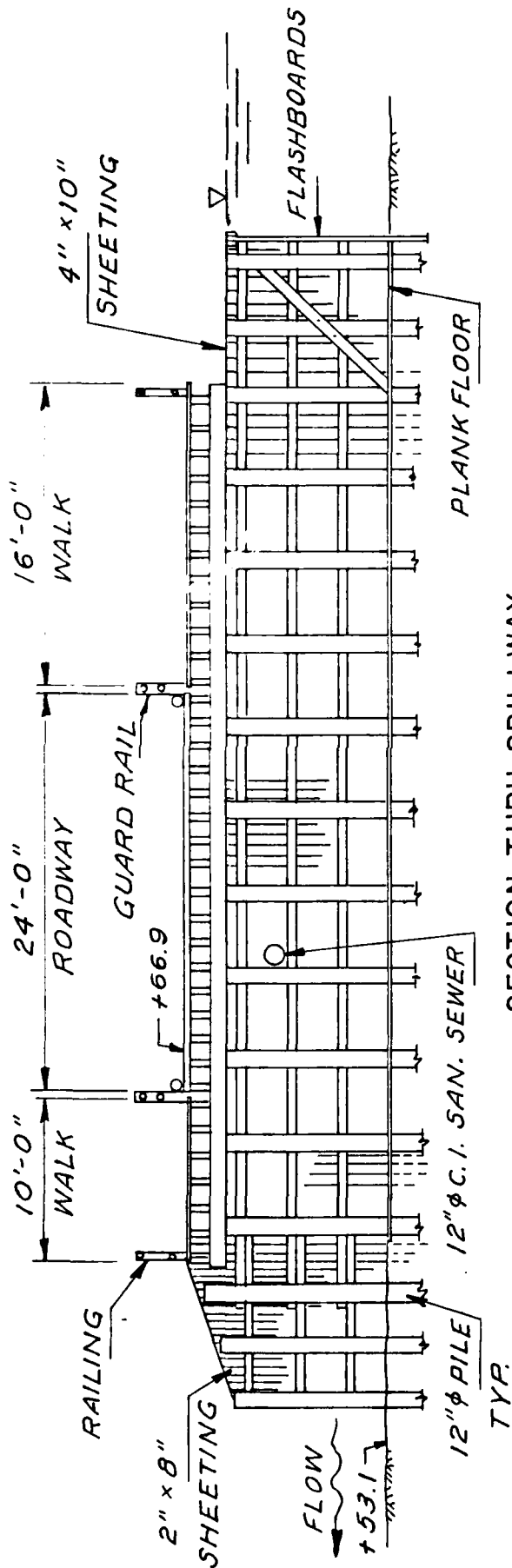


FIGURE 4

Check List
Visual Inspection
Phase I

Name Dam Upper Aetna County Burlington State New Jersey Coordinators NJDEP

Date(s) Inspection 11-12-79
12-27-79 Weather Overcast Temperature 50°

Pool Elevation at Time of Inspection 65.0 M.S.L. Tailwater at Time of Inspection 57.2 M.S.L.

Inspection Personnel:

<u>D. Lang</u>	<u>L. Baines</u>
<u>J. Voorhees</u>	<u>K. Jolls</u>
<u>E. Simone</u>	

D. Lang Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None apparent.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Toe fairly uniform, slopes generally 3:1 on west end fairly well grassed on upstream and downstream slopes except around wingwalls East side slope approaches 1:1. Slight undermining.	
SLOUGHING OR EROSION OF EMBANKMENT AND ADJUTENT SLOPES	Erosion on SW side due to surface runoff. Erosion on NW side due to surface runoff. Pedestrian paths all around timber planking on either side of embankment. Miscellaneous asphalt placed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Fair, roadway embankment asphalt surface length: approx. 200'±	Crest profile satisfactory.
RIPRAP FAILURES	No riprap	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Roadway embankment, asphalt road meets timber bridge structure. Junction good, no real cracking or elevation differential.	
ANY NOTICEABLE SEEPAGE	None	
STAFF GAGE AND RECORDER	None	
DRAINS	None	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	N/A	
INTAKE STRUCTURE		
OUTLET STRUCTURE	Timber bridge - county maintained	
OUTLET CHANNEL	Lower Aetna Lake	
EMERGENCY GATE	none	

UNCATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Overflow timber box spillway, several piles and boards need replacement, horizontally and vertically true, one set of removable flashboards. Lake level down.	
APPROACH CHANNEL	Upper Aetna Lake free and clear of debris.	
DISCHARGE CHANNEL	Lower Aetna Lake free and clear of debris	Discharges into main body of lower lake
BRIDGE AND PIERS	Single span timber bridge deck. Lumber in reasonable shape-integral part of spillway structure.	

RESERVOIR

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

SLOPES

Mild slopes, most, homes have 1-2' timber bulkheads at lakes edge, slope rises gradually to homes.

SEDIMENTATION

Some evident.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Lower Aetna Lake, wide and clear of obstructions.	
--	---	--

SLOPES	Same as Upper Aetna	
--------	---------------------	--

APPROXIMATE NO. OF HOMES AND POPULATION	Many - Significant hazard	
---	---------------------------	--

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available - NJDEP - Division of Water Resources - Bureau of Flood Plain Management - Trenton, New Jersey
REGIONAL VICINITY MAP	Available - USGS Quad - Medford Lakes, New Jersey
CONSTRUCTION HISTORY	Limited amount available
TYPICAL SECTIONS OF DAM	None available
HYDROLOGIC/HYDRAULIC DATA	None available
OUTLETS - PLAN	Available 1946 Reconstruction Plans - NJDEP
- DETAILS	Available
-CONSTRAINTS	Not available
-DISCHARGE RATINGS	Not available
RAINFALL/RESERVOIR RECORDS	None available

ITEM	REMARKS
SPILLWAY PLAN	Available - 1946 reconstruction plans - NJDEP
SECTIONS	Available " " "
DETAILS	Available " " "
OPERATING EQUIPMENT PLANS & DETAILS	Available - 1946 reconstruction plans - NJDEP

ITEM	REMARKS
DESIGN REPORTS	None available
GEOLOGY REPORTS	None available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available " " "
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available " " "
POST-CONSTRUCTION SURVEYS OF DAM	None available
BORROW SOURCES.	Unknown

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	Plans of 1946 Reconstruction available (NJDEP)
HIGH POOL RECORDS	None available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	1970 Inspection report (NJDEP)
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None known
MAINTENANCE OPERATION RECORDS	None available



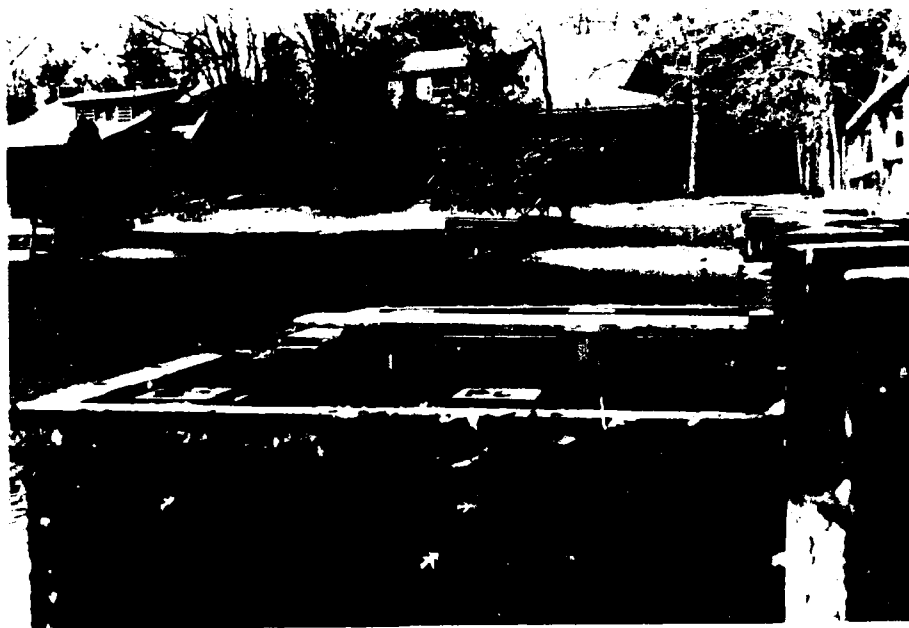
November, 1979

Upstream View of Dam



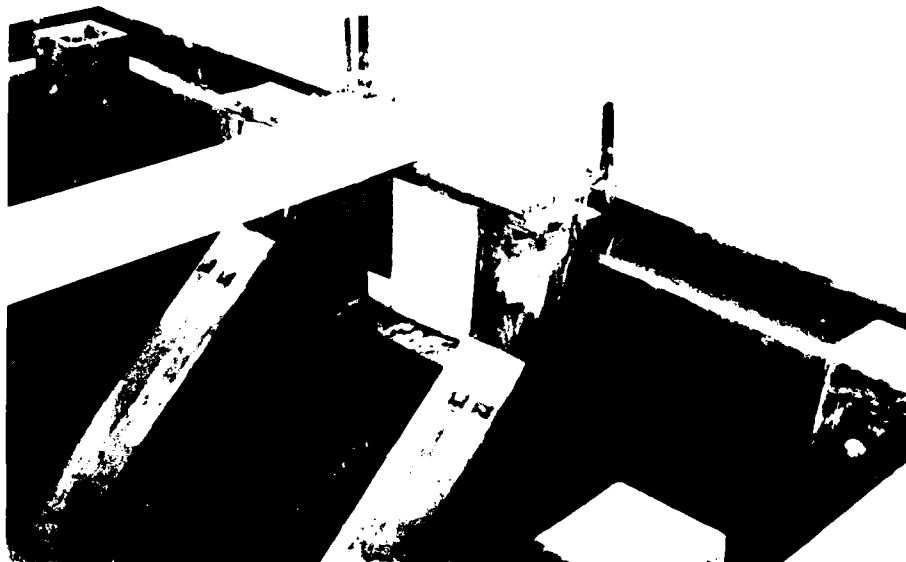
November, 1979

Downstream View of Dam



November, 1979

View of Timber Spillway



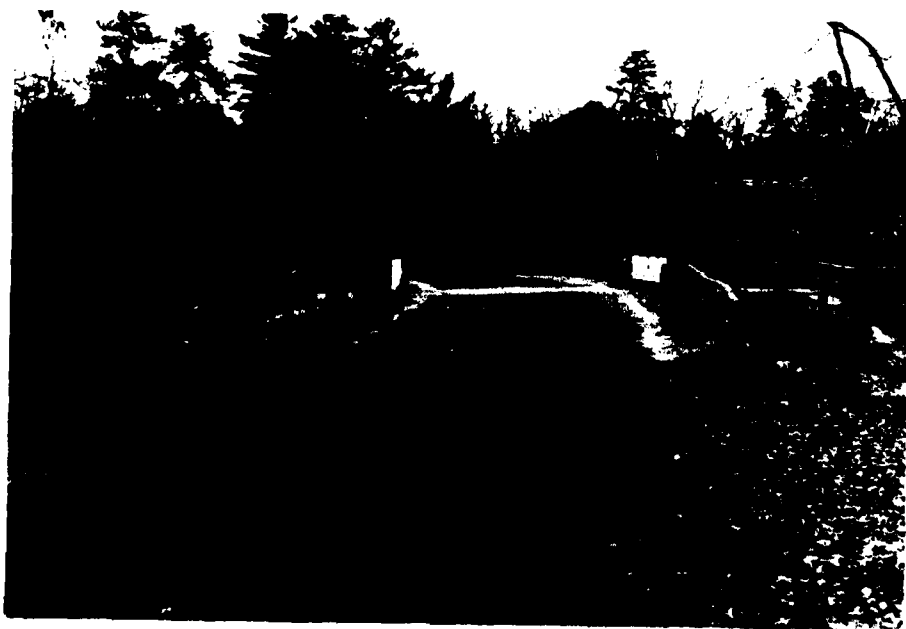
November, 1979

View of 3'-4" Gate



November, 1979

View of Upper Aetna Lake



November, 1979

View of Crest Looking Northeast

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 5.51 square miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 65 M.S.L. (37 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 66.9 M.S.L. (58 acre-feet)

ELEVATION MAXIMUM DESIGN POOL: _____

ELEVATION TOP DAM: 66.9 M.S.L.

CREST: _____

- a. Elevation 66.9 M.S.L.
- b. Type Earth roadway embankment with bridged spillway
- c. Width 26 ± feet
- d. Length 230 ± feet
- e. Location Spillover 80' from left abutment
- f. Number and Type of Gates _____

OUTLET WORKS: _____

- a. Type Timber drop inlet
- b. Location 80' from left abutment
- c. Entrance inverts 65 M.S.L.
- d. Exit inverts 53.1 M.S.L.
- e. Emergency draindown facilities 1 - 3' - 4" timber gate

HYDROMETEOROLOGICAL GAGES: None

- a. Type _____
- b. Location _____
- c. Records _____

MAXIMUM NON-DAMAGING DISCHARGE: 282 cfs

BY L.B. DATE 12-79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A1 OF

CHKD. BY J.C. DATE 12-79

UPPER AETNA LAKE DAM

PROJECT C-246

SUBJECT

TIME OF CONCENTRATION:

CALIFORNIA CULVERTS PRACTICE

Length of Long T WATERCOURSE = 1.21 miles = 6,400 feet

$$\Delta H = 120 - 65 = 55'$$

$$t_c = \left(\frac{11.9 L^3}{H} \right)^{0.385} = \left(\frac{11.9 (1.21)^3}{55} \right)^{0.385} \quad \text{DESIGN OF SMALL DAMS pg. 7}$$

$$t_c = .69 \text{ hrs}$$

ALTERNATE METHOD

$$\text{Slope} = \frac{15}{2400} = .625\%$$

Assume velocity = 2 ft-sec⁻¹

$$t_c = \frac{2400 \text{ ft}}{2 \text{ ft-sec}^{-1} \times 3600 \frac{\text{sec}}{\text{hr}}} = .333 \text{ hr}$$

OVERLAND FLOW

$$\Delta H = 120 - 80 = 40 \text{ feet}$$

$$\text{Slope} = \frac{40}{4000} = 1\%$$

ASSUME VELOCITY = 1.5 ft-sec⁻¹

$$t_c' = \frac{4000 \text{ ft}}{1.5 \times 3600} = .741$$

$$t_c = .333 + .741 = 1.07$$

$$\text{USE } t_c = 0.88 \text{ HRS}$$

BY L.B. DATE 12-79

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A2 OF

CHKD. BY J.C. DATE 12-79

UPPER AETNA LAKE DAM

PROJECT C-244

SUBJECT _____

$$t_p = \frac{1}{2} + 0.6 L_c = \frac{0.25}{2} + 0.6 (.88) = 0.653$$

$$\text{INTERMEDIATE D.A.} = 0.46$$

$$Q_p = 484 \text{ D.A.} / T_p$$

$$= 484 (.46) / .653$$

$$Q_p = 341 \text{ cfs}$$

UNITGRAPH

<u>TIME</u> <u>(HOURS)</u>	<u>T/T_p</u>	<u>DIMENSIONLESS</u> <u>ORDINATE (DO)</u>	<u>Q (cfs)</u> <u>= Q_p x DO</u>
0.25	0.38	0.254	87
0.50	0.77	0.853	293
0.75	1.15	0.952	325
1.00	1.53	0.63	215
1.25	1.91	0.363	124
1.50	2.30	0.208	71
1.75	2.68	0.116	40
2.00	3.06	0.069	24
2.25	3.45	0.0395	13

$$\Sigma = 1192 \text{ cfs}$$

$$\frac{1192}{.45} \times \frac{3600}{5280} \times \frac{12}{4} = 1.004 \approx 1 \quad \text{ok}$$

BY J.C. DATE 12-79 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A3 OF
 CHKD. BY DATE MEDFORD LINKS DAM INSPECTION PROJECT C246
 SUBJECT DEPTH - DURATION RAINFALL DATA FROM TP 40 & HMP 35

100 YR FREQUENCY

TIME	PRECIPITATION	Δ	REARRANGE
0.25	1.7	1.7	0.06
0.50	2.4	0.7	0.06
0.75	2.8	0.4	0.06
1.00	3.1	0.3	0.06
1.25	3.5	0.4	0.07
1.50	3.7	0.2	0.07
1.75	3.86	0.16	0.08
2.00	4.00	0.14	0.09
2.25	4.11	0.11	0.09
2.50	4.22	0.11	0.09
2.75	4.31	0.09	0.11
3.00	4.40	0.09	0.11
3.25	4.49	0.09	0.30
3.50	4.57	0.08	0.70
3.75	4.64	0.07	1.70
4.00	4.71	0.07	0.40
4.25	4.78	0.07	0.40
4.50	4.84	0.06	0.20
4.75	4.90	0.06	0.16
5.00	4.96	0.06	0.14
5.25	5.02	0.06	0.07
5.50	5.08	0.06	0.06
5.75	5.14	0.06	0.06
6.00	5.20	0.06	0.06

A4

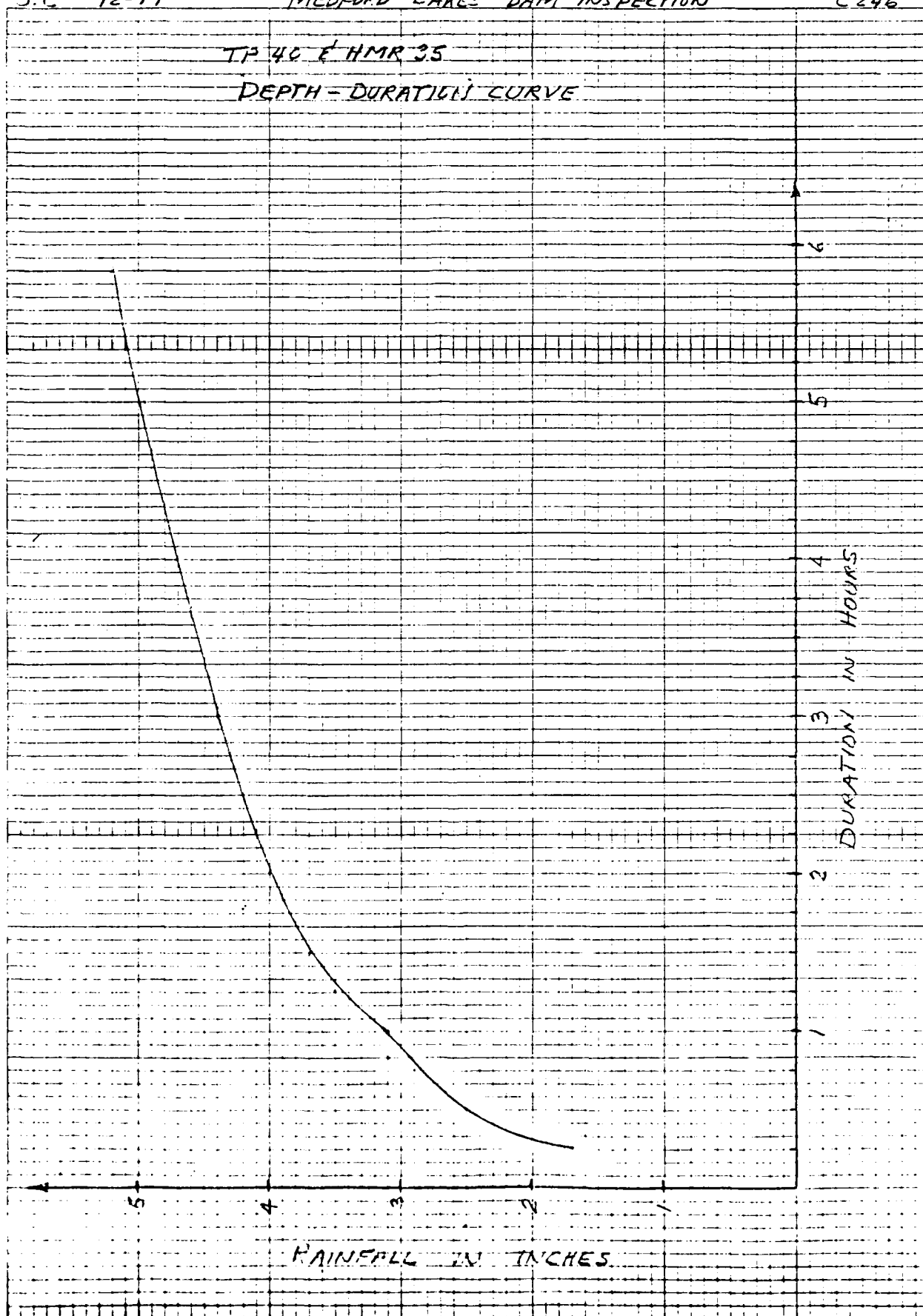
J.C. 12-79

MEDFORD LAKES DAM INSPECTION

C246

TP 40 E HMR 35

DEPTH-DURATION CURVE



46 0706

10 X 10 TO THE INCH 7 X 10 INCHES
ALJFEL & LESTER CO. MADE IN U.S.A.

BY L.B. DATE 12-77

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A5 OF

CHKD. BY J.C. DATE 12/13/77

UPPER AETNA LAKE DAM

PROJECT C-246

SUBJECT DISCHARGE CAPACITY

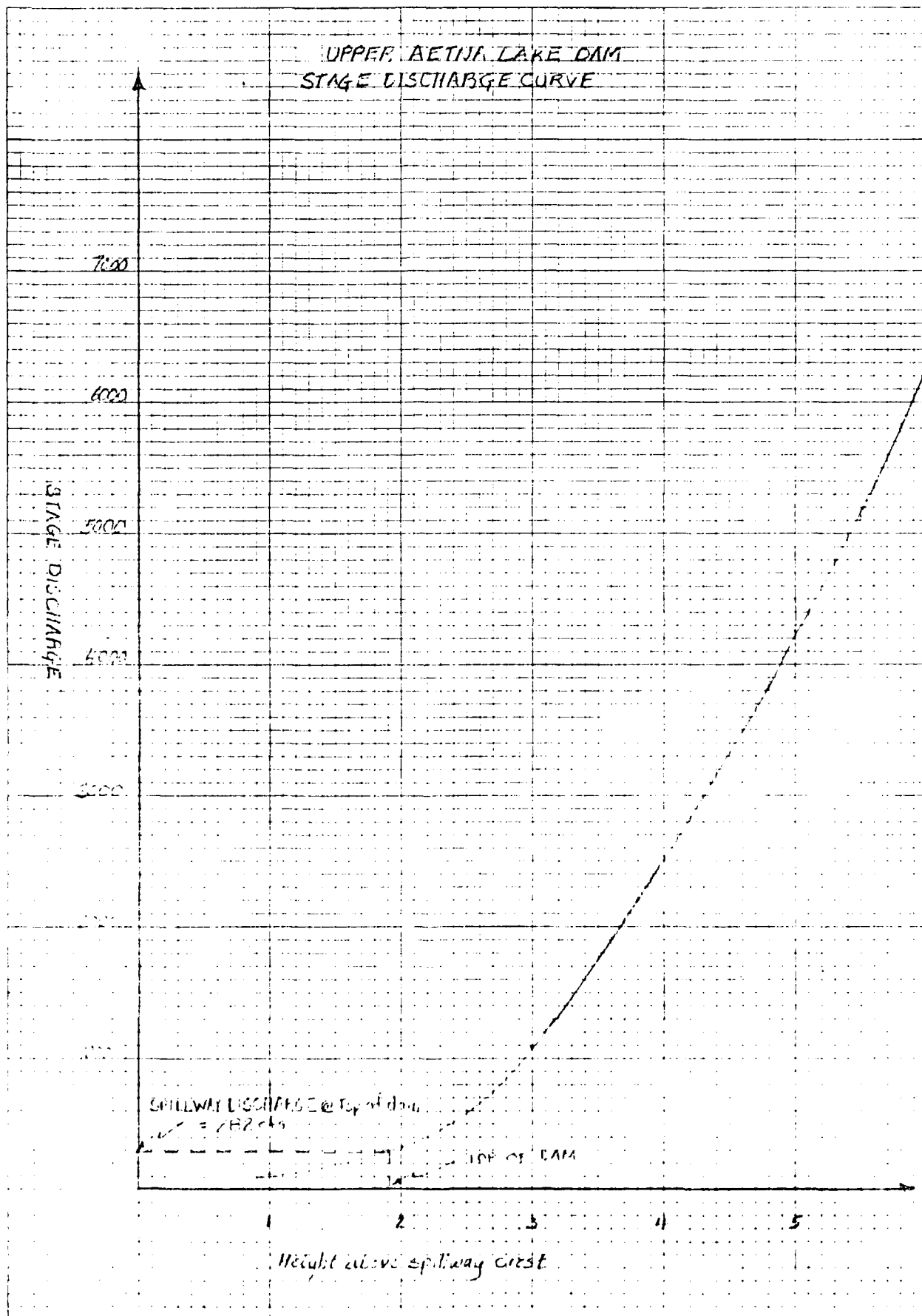
SPILLWAY SECTION EFFECTIVE LENGTH = 31.67' @ EL. 65

TOP OF DAM LENGTH = 230' @ EL. 66.94

OVER SPILLWAY L = 31.67'			OVER DAM L = 213'			Σ Q
H	C	Q	H	C	Q	
1	3.3	105				105
2	3.3	296	1.06	2.8	9	305
3	3.3	543	1.06	2.8	651	1,194
4	3.0	760	2.06	2.8	1,703	2,523
5	3.0	1062	3.06	2.8	3,192	4,254
6	3.0	1396	4.06	2.8	4,879	6,275
7	3.0	1760	5.06	2.8	6,788	8,548
8	3.0	2150	6.06	2.8	8,817	11,047
9	3.0	2565	7.06	2.8	11,188	13,753
10	3.0	3004	8.06	2.8	13,647	16,651

TOP OF DAM DISCHARGE = 282 cfs @ EL. 66.94

UPPER AETNA LAKE DAM STAGE DISCHARGE CURVE



46 0706

SEE FIG. 10 TO THE NORTH AT THE DAM

BY L.B. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A7 OF _____

CHKD. BY AL DATE _____

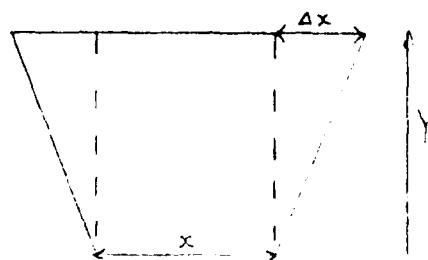
DIRECTORIAL LAKESIDE

PROJECT 2

SUBJECT SPILLWAY STORAGE

AREA OF LAKE @ EL. 65 = 23.1 acres

AREA OF CONTOUR @ EL 70 = 57.3 acres

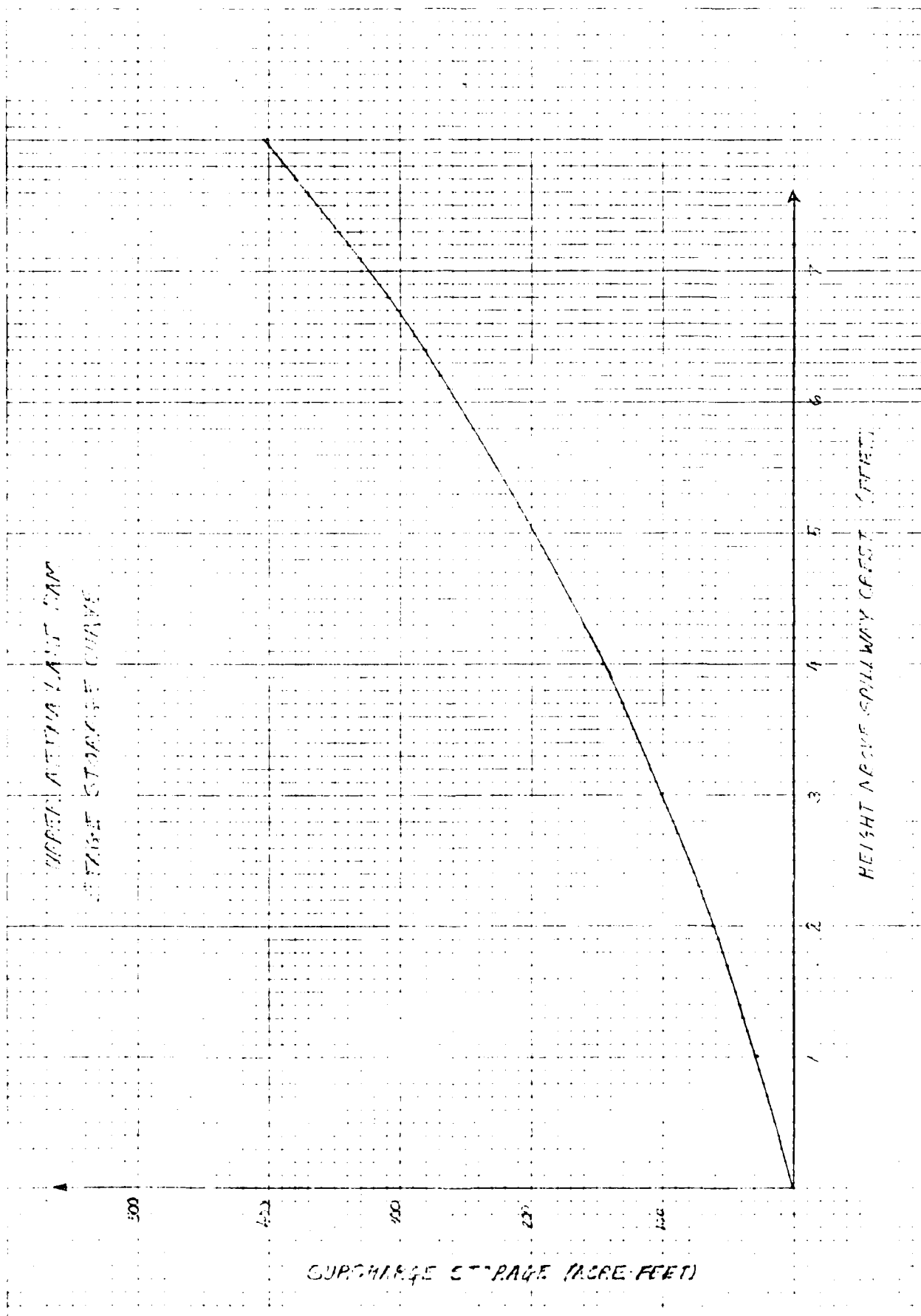


EL. 62

$$\text{INCREMENT IN VOLUME } \Delta V = (x + \Delta x)Y$$

ELEVATION (M.S.L.)	HEIGHT ABOVE CREST (FEET)	STORAGE (ACRE-FEET)
66	1	27
67	2	60
68	3	100
69	4	147
70	5	201
71	6	262
72	7	327
73	8	404
74	9	485
75	10	573

46 9766



BY L.B. DATE 12-77

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A9 OF

CHKD. BY _____ DATE _____

UPPER AETNA LAKE DAM

PROJECT C-246

SUBJECT APPROXIMATE DRAWDOWN CALCULATIONS

STORAGE AT NORMAL POOL = 37 acre-feet

AVAILABLE HEAD = 11.9 feet

ASSUME DRAWDOWN IN TWO STAGES WITH ALL 3'-4" WIDE
STOPLOGS REMOVED

ASSUME TIDING OF 6 cfs AND NO FLOW WATER

STAGE 1

$$H = 8.9 \text{ feet}$$

$$Q = CLH^{3/2} - 6 \quad L = 3.33 \text{ feet} \quad C = 3.1$$

$$Q = 3.1(3.33)(8.9)^{3/2} - 6$$
$$= 262$$

$$\text{Time} = \frac{37 \text{ acre-feet} \times 43560 \text{ ft}^2/\text{acre}}{262 \text{ ft}^3/\text{sec} \times 3600 \text{ sec/hr} \times 2}$$

$$= 0.84 \text{ hours}$$

STAGE 2

$$H = 2.93 \text{ feet}$$

$$Q = 3.1(3.33)(2.93)^{1.5} - 6$$

$$Q = 47.6 \text{ cfs}$$

$$\text{Time} = \frac{37 \text{ acre-feet} \times 43560 \text{ ft}^2/\text{acre}}{47.6 \text{ ft}^3/\text{sec} \times 3600 \text{ sec/hr} \times 2}$$

$$= 4.76 \text{ hr}$$

$$\text{TOTAL DRAWDOWN TIME} = 0.84 \text{ hr} + 4.76 \text{ hr}$$

$$= 5.6 \text{ hr}$$

BY L.B. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A10 OF _____

CHKD. BY _____ DATE _____

MEDFORD LAKES DAM INSPECTIONPROJECT C-246SUBJECT UPPER STOKES DAM

RECEIVED LAKES DAM INSPECTION - STOKES, STOCKWELL, UPPER & LOWER AETHA LAKES
BY L. B. SHINES
MARCH, 1980

JOB SPECIFICATION

NO	NHR	NNIN	ICHT	IHP	ININ	METRC	IPLT	IPET	INSTAN
150	0	15	0	0	0	0	0	0	0
			JOPEP	NUT					
			3	0					

7

SUB-AREA RUNOFF COMPUTATION

INFLOW TO STOKES LAKE

ISTHQ	ICOMP	IECON	ITAPE	JFLT	JFRT	INANE
1	0	0	0	0	0	1

HYDROGRAPH DATA

THVDS	ISHC	TAREA	SNAP	TRSDH	TRSPD	RATIO	ISNOU	ISAME	LOCAL
2	-1	1.55	0.00	1.55	0.00	0.000	0	0	0

PRECIP DATA

NP	STORM	DAJ	DAK
24	0.05	0.00	0.00

PRECIP PATTERN

0.00	0.06	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.09
0.11	0.11	0.30	0.70	1.70	0.40	0.40	0.20	0.16	0.14
0.02	0.02	0.02	0.02						

LOSS DATA

STPA	ETAP	RTIOL	ERAIN	STPDS	RTIOL	STRTL	CHETL	ALSHA	RTIMP
0.10	0.00	1.00	0.00	0.00	1.00	0.50	0.10	0.00	0.00

GIVEN UNIT GRAPH. NUH00= .11

225	705	1039	741	403	257	172	105	65	39
25									

UNIT GRAPH TOTALS 4022. CFS OR 1.01 INCHES OVER THE AREA

RECESSION DATA

STIOW=	0.00	CPLOS=	0.00	FTIOF=	1.00
--------	------	--------	------	--------	------

END-OF-PERIOD FLOW

TIME	RAIN	EQCS	COMP
1	0.00	0.00	0
2	0.06	0.00	0
3	0.06	0.00	0
4	0.11	0.00	0
5	0.07	0.00	0
6	0.07	0.00	0
7	0.06	0.00	0
8	0.09	0.04	0
9	0.02	0.02	43
10	0.02	0.02	103
11	0.11	0.08	166

BY L.B. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A11 OF _____

CHKD. BY _____ DATE _____

MEDFORD LAKES DAM INSPECTIONPROJECT C-246SUBJECT UPPER STOKES DAM

12	0.11	0.08	222
13	0.20	0.27	310
14	0.70	0.67	580
15	1.70	1.67	1035
16	0.40	0.38	2404
17	0.40	0.38	2836
18	0.20	0.18	2481
19	0.16	0.13	1914
20	0.14	0.12	1445
21	0.07	0.04	1080
22	0.06	0.03	763
23	0.06	0.03	537
24	0.06	0.03	379
25	0.00	0.00	270
26	0.00	0.00	164
27	0.00	0.00	100
28	0.00	0.00	55
29	0.00	0.00	31
30	0.00	0.00	17
31	0.00	0.00	8
32	0.00	0.00	5
33	0.00	0.00	2
34	0.00	0.00	1
35	0.00	0.00	0
36	0.00	0.00	0
37	0.00	0.00	0
38	0.00	0.00	0
39	0.00	0.00	0
40	0.00	0.00	0
41	0.00	0.00	0
42	0.00	0.00	0
43	0.00	0.00	0
44	0.00	0.00	0
45	0.00	0.00	0
46	0.00	0.00	0
47	0.00	0.00	0
48	0.00	0.00	0
49	0.00	0.00	0
50	0.00	0.00	0
51	0.00	0.00	0
52	0.00	0.00	0
53	0.00	0.00	0
54	0.00	0.00	0
55	0.00	0.00	0
56	0.00	0.00	0
57	0.00	0.00	0
58	0.00	0.00	0
59	0.00	0.00	0
60	0.00	0.00	0
61	0.00	0.00	0
62	0.00	0.00	0
63	0.00	0.00	0
64	0.00	0.00	0
65	0.00	0.00	0
66	0.00	0.00	0
67	0.00	0.00	0
68	0.00	0.00	0
69	0.00	0.00	0
70	0.00	0.00	0
71	0.00	0.00	0
72	0.00	0.00	0
73	0.00	0.00	0
74	0.00	0.00	0
75	0.00	0.00	0
76	0.00	0.00	0
77	0.00	0.00	0

78	0.00	0.00	0
79	0.00	0.00	0
80	0.00	0.00	0
81	0.00	0.00	0
82	0.00	0.00	0
83	0.00	0.00	0
84	0.00	0.00	0
85	0.00	0.00	0
86	0.00	0.00	0
87	0.00	0.00	0
88	0.00	0.00	0
89	0.00	0.00	0
90	0.00	0.00	0
91	0.00	0.00	0
92	0.00	0.00	0
93	0.00	0.00	0
94	0.00	0.00	0
95	0.00	0.00	0
96	0.00	0.00	0
97	0.00	0.00	0
98	0.00	0.00	0
99	0.00	0.00	0
100	0.00	0.00	0
101	0.00	0.00	0
102	0.00	0.00	0
103	0.00	0.00	0
104	0.00	0.00	0
105	0.00	0.00	0
106	0.00	0.00	0
107	0.00	0.00	0
108	0.00	0.00	0
109	0.00	0.00	0
110	0.00	0.00	0
111	0.00	0.00	0
112	0.00	0.00	0
113	0.00	0.00	0
114	0.00	0.00	0
115	0.00	0.00	0
116	0.00	0.00	0
117	0.00	0.00	0
118	0.00	0.00	0
119	0.00	0.00	0
120	0.00	0.00	0
121	0.00	0.00	0
122	0.00	0.00	0
123	0.00	0.00	0
124	0.00	0.00	0
125	0.00	0.00	0
126	0.00	0.00	0
127	0.00	0.00	0
128	0.00	0.00	0
129	0.00	0.00	0
130	0.00	0.00	0
131	0.00	0.00	0
132	0.00	0.00	0
133	0.00	0.00	0
134	0.00	0.00	0
135	0.00	0.00	0
136	0.00	0.00	0
137	0.00	0.00	0
138	0.00	0.00	0
139	0.00	0.00	0
140	0.00	0.00	0
141	0.00	0.00	0
142	0.00	0.00	0
143	0.00	0.00	0

SHEET NO. A12 OF _____
PROJECT C-246

SUBJECT UPPER STOKES DAM

144	0.00	0.00	0	0	
145	0.00	0.00	0	0	
146	0.00	0.00	0	0	
147	0.00	0.00	0	0	
148	0.00	0.00	0	0	
149	0.00	0.00	0	0	
150	0.00	0.00	0	0	
SUM 5.00 4.27 17239					
PERM	4.00	2.00	115	1023	
1000	4.00	4.00	4.31	4.31	
1000	4.00	4.00	350	350	
HSC000					

BY L.B. DATE

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 113 OF

CHKD. BY DATE

MEDFORD LAKES DAM INSPECTION

PROJECT C-146

SUBJECT UPPER STORES DAM

32	10	0	47	90	1	0	2
33	15	3	44	91	1	0	2
34	14	2	40	100	1	0	2
35	13	0	37	101	1	0	2
36	12	0	34	102	1	0	2
37	12	0	31	103	1	0	1
38	11	0	29	104	1	0	1
39	11	0	26	105	1	0	1
40	10	0	24	106	1	0	1
41	10	0	22	107	1	0	1
42	9	0	21	108	1	0	1
43	9	0	19	109	1	0	1
44	8	0	17	110	1	0	1
45	8	0	16	111	1	0	1
46	8	0	15	112	1	0	1
47	7	0	15	113	0	0	1
48	7	0	14	114	0	0	1
49	7	0	14	115	0	0	1
50	6	0	13	116	0	0	1
51	6	0	12	117	0	0	1
52	6	0	12	118	0	0	1
53	6	0	11	119	0	0	1
54	5	0	11	120	0	0	1
55	5	0	11	121	0	0	1
56	5	0	10	122	0	0	1
57	5	0	10	123	0	0	1
58	5	0	9	124	0	0	1
59	4	0	9	125	0	0	1
60	4	0	9	126	0	0	1
61	4	0	8	127	0	0	1
62	4	0	8	128	0	0	1
63	4	0	8	129	0	0	0
64	4	0	7	130	0	0	0
65	3	0	7	131	0	0	0
66	3	0	7	132	0	0	0
67	3	0	6	133	0	0	0
68	3	0	6	134	0	0	0
69	3	0	6	135	0	0	0
70	3	0	6	136	0	0	0
71	3	0	5	137	0	0	0
72	3	0	5	138	0	0	0
73	3	0	5	139	0	0	0
74	2	0	5	140	0	0	0
75	2	0	5	141	0	0	0
76	2	0	4	142	0	0	0
77	2	0	4	143	0	0	0
78	2	0	4	144	0	0	0
79	2	0	4	145	0	0	0
80	2	0	4	146	0	0	0
81	2	0	4	147	0	0	0
82	2	0	3	148	0	0	0
83	2	0	3	149	0	0	0
84	2	0	3	150	0	0	0
85	2	0	3				
86	1	0	3				
87	1	0	3				
88	1	0	3				
89	1	0	3				
90	1	0	2				
91	1	0	2				
92	1	0	2				
93	1	0	2				
94	1	0	2				
95	1	0	2				
96	1	0	2				
97	1	0	2				

SUM

17234

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2052	692	179	111	17234
INCHES		4.16	4.30	4.31	4.31
MC-FT		344	356	356	356

SUB-AREA RUNOFF COMPUTATION

BY L.B. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A14 OF _____

CHKD. BY _____ DATE _____

MEDEARD LAKES DAM INSPECTIONPROJECT C-246SUBJECT LAKE STOCKWELL DAM

INFLOW TO LAKE STOCKWELL

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
2	0	0	0	0	0	1

HYDROGRAPH DATA

THYGC	IUNG	TAREH	SNAP	TPSCA	TPSPC	RATIO	ISHOW	ISAME	LOCAL
0	-1	3.50	0.00	3.50	0.00	0.000	0	0	0

PRECIP DATA

HP	STORM	DAJ	DAK
24	0.00	0.00	0.00

PRECIP PATTERN

0.00	0.06	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.09
0.11	0.11	0.30	0.70	1.70	0.40	0.40	0.20	0.16	0.14
0.07	0.06	0.06	0.06						

LOSS DATA

STPKX	DLTAR	RTIOL	EPAIN	STPKS	RTIOK	STRTL	CNSTL	ALSHX	RTIMP
0.00	0.00	1.00	0.00	0.00	1.00	0.50	0.10	0.00	0.00

GIVEN UNIT GRAPH, HUNGQ= 18

116	436	916	1293	1406	1250	954	709	534	402
299	210	157	117	83	65	48	37	25	

UNIT GRAPH TOTALS 9100 CFS OR 1.01 INCHES OVER THE AREA

RECESSION DATA

STRTQ=	0.00	OPEN=	0.00	RTIOP=	1.00
--------	------	-------	------	--------	------

END-OF-PERIOD FLOW

TIME	RAIN	ENC5	COMP 0
1	0.00	0.00	0.
2	0.00	0.00	0.
3	0.00	0.00	0.
4	0.00	0.00	0.
5	0.07	0.00	0.
6	0.07	0.00	0.
7	0.00	0.00	0.
8	0.09	0.04	4.
9	0.09	0.07	23.
10	0.09	0.07	69.
11	0.11	0.09	144.
12	0.11	0.09	241.
13	0.30	0.27	368.
14	0.70	0.67	594.
15	1.70	1.67	1141.
16	0.40	0.38	2103.
17	0.40	0.30	3230.
18	0.20	0.18	4203.
19	0.16	0.13	4552.
20	0.14	0.12	4317.
21	0.07	0.04	3764.
22	0.06	0.03	3111.
23	0.06	0.03	2548.
24	0.06	0.03	2048.
25	0.00	0.00	1624.
26	0.00	0.00	1267.
27	0.00	0.00	979.
28	0.00	0.00	749.
29	0.00	0.00	564.
30	0.00	0.00	412.
31	0.00	0.00	307.
32	0.00	0.00	223.
33	0.00	0.00	150.
34	0.00	0.00	79.
35	0.00	0.00	51.

BY L.B. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A15 OF _____

CHKD. BY _____ DATE _____

MEDFORD LAKES DAM INSPECTION

PROJECT C-246

SUBJECT LAKE STOCKNELL DAM

36	0.00	0.00	30
37	0.00	0.00	12
38	0.00	0.00	12
39	0.00	0.00	6
40	0.00	0.00	4
41	0.00	0.00	2
42	0.00	0.00	1
43	0.00	0.00	0
44	0.00	0.00	0
45	0.00	0.00	0
46	0.00	0.00	0
47	0.00	0.00	0
48	0.00	0.00	0
49	0.00	0.00	0
50	0.00	0.00	0
51	0.00	0.00	0
52	0.00	0.00	0
53	0.00	0.00	0
54	0.00	0.00	0
55	0.00	0.00	0
56	0.00	0.00	0
57	0.00	0.00	0
58	0.00	0.00	0
59	0.00	0.00	0
60	0.00	0.00	0
61	0.00	0.00	0
62	0.00	0.00	0
63	0.00	0.00	0
64	0.00	0.00	0
65	0.00	0.00	0
66	0.00	0.00	0
67	0.00	0.00	0
68	0.00	0.00	0
69	0.00	0.00	0
70	0.00	0.00	0
71	0.00	0.00	0
72	0.00	0.00	0
73	0.00	0.00	0
74	0.00	0.00	0
75	0.00	0.00	0
76	0.00	0.00	0
77	0.00	0.00	0
78	0.00	0.00	0
79	0.00	0.00	0
80	0.00	0.00	0
81	0.00	0.00	0
82	0.00	0.00	0
83	0.00	0.00	0
84	0.00	0.00	0
85	0.00	0.00	0
86	0.00	0.00	0
87	0.00	0.00	0
88	0.00	0.00	0
89	0.00	0.00	0
90	0.00	0.00	0
91	0.00	0.00	0
92	0.00	0.00	0
93	0.00	0.00	0
94	0.00	0.00	0
95	0.00	0.00	0
96	0.00	0.00	0
97	0.00	0.00	0
98	0.00	0.00	0
99	0.00	0.00	0
100	0.00	0.00	0
101	0.00	0.00	0

BY L.B. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A16 OF _____

CHKD. BY _____ DATE _____

MEDEFORD LAKES DAM INSPECTION

PROJECT C-246

SUBJECT LAKE STOCKWELL DAM

102	0.00	0.00	0
103	0.00	0.00	0
104	0.00	0.00	0
105	0.00	0.00	0
106	0.00	0.00	0
107	0.00	0.00	0
108	0.00	0.00	0
109	0.00	0.00	0
110	0.00	0.00	0
111	0.00	0.00	0
112	0.00	0.00	0
113	0.00	0.00	0
114	0.00	0.00	0
115	0.00	0.00	0
116	0.00	0.00	0
117	0.00	0.00	0
118	0.00	0.00	0
119	0.00	0.00	0
120	0.00	0.00	0
121	0.00	0.00	0
122	0.00	0.00	0
123	0.00	0.00	0
124	0.00	0.00	0
125	0.00	0.00	0
126	0.00	0.00	0
127	0.00	0.00	0
128	0.00	0.00	0
129	0.00	0.00	0
130	0.00	0.00	0
131	0.00	0.00	0
132	0.00	0.00	0
133	0.00	0.00	0
134	0.00	0.00	0
135	0.00	0.00	0
136	0.00	0.00	0
137	0.00	0.00	0
138	0.00	0.00	0
139	0.00	0.00	0
140	0.00	0.00	0
141	0.00	0.00	0
142	0.00	0.00	0
143	0.00	0.00	0
144	0.00	0.00	0
145	0.00	0.00	0
146	0.00	0.00	0
147	0.00	0.00	0
148	0.00	0.00	0
149	0.00	0.00	0
150	0.00	0.00	0

SUM 5.20 4.27 39001

	CFS	PERF	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
		4552	1016	406	200	39004
	INCHES		4.29	4.32	4.32	4.32
	AC-FT		802.	806	806	806

COMBINE HYDROGRAPHS

COMBINE ROUTED HYD	STOKES DAM & INFLOW HYD.	TO STOKES				
ISTHD	ICOMP	IECON	ITAPE	JPLT	JEFT	INAME
22	2	0	0	0	0	1

SHEET NO. 17 OF _____

PROJECT C-246

LAKE STOCKWELL DAM INSPECTION

	PERY	6-HOUR	24-HOUR	72-HOUR	TOTAL	VOLUME
CES	662	2007	555	375	56237	56237
INCHES		4.25	4.31	4.32		4.32
AC-FT		1181	1144	1163		1163

ROUTING THROUGH LAKE STOKELL - 773045015 EAR7 HEN08M1 5M1166R

TIME	EOF STOP	Avg IN	EXP OUT
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
9	0	14	1
10	1	19	2
11	4	113	3
12	8	209	13
13	14	332	23
14	29	590	45
15	51	1000	144
16	100	1500	460
17	184	1995	1057
18	304	3377	3669
19	522	5004	4612
20	851	7333	5351
21	1340	10000	5715
22	2340	16543	50761

BY L.B. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A18 OF _____

CHKD. BY _____ DATE _____

MEDFORD LAKES DAM INSPECTIONPROJECT C-246SUBJECT LAKE STOCKWELL DAM

23	316	3642	4551
24	283	2905	3013
25	261	2337	3090
26	236	1766	2725
27	212	1338	2336
28	191	1000	1300
29	173	739	1420
30	157	548	1180
31	144	415	903
32	132	314	764
33	122	232	670
34	114	157	597
35	106	104	458
36	99	76	411
37	92	58	363
38	85	45	349
39	80	37	283
40	75	30	241
41	70	26	232
42	66	23	206
43	62	20	191
44	59	18	177
45	56	17	164
46	53	16	152
47	50	15	140
48	48	14	130
49	45	14	121
50	43	13	112
51	41	13	104
52	39	12	96
53	38	12	89
54	36	11	83
55	35	11	77
56	33	10	72
57	32	10	66
58	31	10	62
59	30	9	58
60	29	9	54
61	28	8	50
62	27	8	48
63	27	8	46
64	26	7	45
65	25	7	44
66	24	7	42
67	24	7	41
68	23	6	40
69	22	6	39
70	21	6	38
71	21	6	37
72	20	5	35
73	20	5	34
74	19	5	33
75	18	5	32
76	18	5	31
77	17	4	30
78	17	4	29
79	16	4	28
80	16	4	27
81	15	4	27
82	15	4	26
83	14	3	25
84	14	3	24
85	13	3	24
86	13	3	23
87	12	2	22
88	12	3	21

BY L.B. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 119 OF _____

CHKD. BY _____ DATE _____

MEDEARD LAKES DAM INSPECTION

PROJECT C-241

SUBJECT LAKE STOCKWELL DAM

100	12	3	21
101	11	3	20
102	11	2	19
103	11	2	19
104	10	2	18
105	10	2	18
106	10	2	17
107	9	2	17
108	9	2	16
109	9	2	16
110	9	2	15
111	8	2	15
112	8	2	14
113	8	2	14
114	8	1	13
115	7	1	13
116	7	1	12
117	7	1	12
118	7	1	12
119	7	1	11
120	6	1	11
121	6	1	11
122	6	1	10
123	6	1	10
124	5	1	9
125	5	1	9
126	5	1	8
127	5	1	8
128	5	1	8
129	5	1	8
130	4	1	7
131	4	1	7
132	4	1	7
133	4	1	7
134	4	1	6
135	4	1	6
136	3	1	6
137	3	1	6
138	3	1	6
139	3	0	5
140	3	0	5
141	3	0	5
142	3	0	5
143	3	0	5
144	3	0	5
145	2	0	4
146	2	0	4
147	2	0	4
148	2	0	4
149	2	0	4
150	2	0	3
151	2	0	3

500

56161

PEAK	6-HOUR	24-HOUR	32-HOUR	TOTAL VOLUME
5378	2157	582	374	56161
	3.47	4.2	4.31	4.31
	1000	1150	1101	1101

BY L.B. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A22 OF _____

CHKD. BY _____ DATE _____

MEDFORD LAKES DAM INSPECTION

PROJECT C-246SUBJECT UPPER AETNA LAKE

SUB-AREA FLOOD COMPUTATION

INFLUX TO UPPER AETNA LAKE - FLOW FROM DUKES UP STORM

INCH	FEET	INCH	FEET	INCH	FEET	INCH	FEET	INCH	FEET
3	0	0	0	0	0	0	0	1	

INCH	FEET	TARE	SNOW	TRUCK	INSPE	PATIO	ISHOW	ISANE	LOREL
0	-1	0.46	0.00	0.46	0.00	0.000	0	0	0

HP	STORM	DAI	DAI
24	0.00	0.00	0.00

PRECIP. DATA	PRECIP. DATA	PRECIP. DATA	PRECIP. DATA	PRECIP. DATA	PRECIP. DATA	PRECIP. DATA	PRECIP. DATA	PRECIP. DATA	PRECIP. DATA
0.00	0.06	0.06	0.00	0.07	0.07	0.03	0.09	0.00	0.00
0.11	0.11	0.30	0.70	1.70	0.40	0.40	0.20	0.10	0.14
0.02	0.00	0.00	0.00						

LOSS DATA

STORM	STORM	STORM	STORM	STORM	STORM	STORM	STORM	STORM	STORM
0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.10	0.00	0.00

GIVEN UNIT GRAPH. HUNCOF = 0

87 293 325 215 124 71 40 24 13

UNIT GRAPH TOTALS 1192. CFS OR 1.00 INCHES OVER THE AREA

RECESSION DATA

STORM = 0.00 ORIGIN = 0.00 PTIME = 1.00

END-OF-PERIOD FLOW

TIME	PAIR	END	COMP
1	0.00	0.00	0
2	0.00	0.00	0
3	0.00	0.00	0
4	0.00	0.00	0
5	0.00	0.00	0
6	0.00	0.00	0
7	0.00	0.00	0
8	0.00	0.04	3
9	0.00	0.07	14
10	0.00	0.07	30
11	0.11	0.00	55
12	0.11	0.00	72
13	0.20	0.27	101
14	0.20	0.67	140
15	1.70	1.67	470
16	0.40	0.39	822
17	0.40	0.70	878
18	0.20	0.10	710
19	0.10	0.10	530
20	0.14	0.12	380
21	0.07	0.04	270
22	0.00	0.07	180
23	0.00	0.03	120
24	0.00	0.00	70
25	0.00	0.00	50
26	0.00	0.00	30
27	0.00	0.00	21

BY L.B. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A21 OF _____

CHKD. BY _____ DATE _____

MEADOW LAKES DAM INSPECTIONPROJECT C-1242SUBJECT UPPER AETNA LAKE

28	0.00	0.00	11
29	0.00	0.00	5
30	0.00	0.00	3
31	0.00	0.00	1
32	0.00	0.00	0
33	0.00	0.00	0
34	0.00	0.00	0
35	0.00	0.00	0
36	0.00	0.00	0
37	0.00	0.00	0
38	0.00	0.00	0
39	0.00	0.00	0
40	0.00	0.00	0
41	0.00	0.00	0
42	0.00	0.00	0
43	0.00	0.00	0
44	0.00	0.00	0
45	0.00	0.00	0
46	0.00	0.00	0
47	0.00	0.00	0
48	0.00	0.00	0
49	0.00	0.00	0
50	0.00	0.00	0
51	0.00	0.00	0
52	0.00	0.00	0
53	0.00	0.00	0
54	0.00	0.00	0
55	0.00	0.00	0
56	0.00	0.00	0
57	0.00	0.00	0
58	0.00	0.00	0
59	0.00	0.00	0
60	0.00	0.00	0
61	0.00	0.00	0
62	0.00	0.00	0
63	0.00	0.00	0
64	0.00	0.00	0
65	0.00	0.00	0
66	0.00	0.00	0
67	0.00	0.00	0
68	0.00	0.00	0
69	0.00	0.00	0
70	0.00	0.00	0
71	0.00	0.00	0
72	0.00	0.00	0
73	0.00	0.00	0
74	0.00	0.00	0
75	0.00	0.00	0
76	0.00	0.00	0
77	0.00	0.00	0
78	0.00	0.00	0
79	0.00	0.00	0
80	0.00	0.00	0
81	0.00	0.00	0
82	0.00	0.00	0
83	0.00	0.00	0
84	0.00	0.00	0
85	0.00	0.00	0
86	0.00	0.00	0
87	0.00	0.00	0
88	0.00	0.00	0
89	0.00	0.00	0
90	0.00	0.00	0
91	0.00	0.00	0
92	0.00	0.00	0
93	0.00	0.00	0

BY L.B. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A22 OF _____

CHKD. BY _____ DATE _____

MEDFORD LAKES DAM INSPECTION

PROJECT C-246

SUBJECT UPPER AETNA LAKE

94	0.00	0.00	0
95	0.00	0.00	0
96	0.00	0.00	0
97	0.00	0.00	0
98	0.00	0.00	0
99	0.00	0.00	0
100	0.00	0.00	0
101	0.00	0.00	0
102	0.00	0.00	0
103	0.00	0.00	0
104	0.00	0.00	0
105	0.00	0.00	0
106	0.00	0.00	0
107	0.00	0.00	0
108	0.00	0.00	0
109	0.00	0.00	0
110	0.00	0.00	0
111	0.00	0.00	0
112	0.00	0.00	0
113	0.00	0.00	0
114	0.00	0.00	0
115	0.00	0.00	0
116	0.00	0.00	0
117	0.00	0.00	0
118	0.00	0.00	0
119	0.00	0.00	0
120	0.00	0.00	0
121	0.00	0.00	0
122	0.00	0.00	0
123	0.00	0.00	0
124	0.00	0.00	0
125	0.00	0.00	0
126	0.00	0.00	0
127	0.00	0.00	0
128	0.00	0.00	0
129	0.00	0.00	0
130	0.00	0.00	0
131	0.00	0.00	0
132	0.00	0.00	0
133	0.00	0.00	0
134	0.00	0.00	0
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	PEAK 872	6-HOUR 213	24-HOUR 53	72-HOUR 24	TOTAL VOLUME 5102
CFS					
INCHES	4.30	4.30	4.30	4.30	4.30
FOOT	100	100	100	100	100

SHEET NO. A23 OF

PROJECT C-244

PROJECT C-244

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	PEAK	0-HOUR	2-HOUR	72-HOUR	TOTAL VOLUME
0-1	0.00	0.00	0.00	400	612.0
1-2	0.00	0.00	0.00	4.31	4.31
2-3	0.00	0.00	0.00	12.72	12.72
3-4	0.00	0.00	0.00	18.67	18.67

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$\frac{1}{\sqrt{\pi}} \int_{-\infty}^{\infty} f(x) e^{-x^2} dx = \frac{1}{\sqrt{\pi}}$

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BY L.E. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. A24 OF _____

CHKD. BY _____ DATE _____

MERFORD LAKES DAM INSPECTION

PROJECT C-246SUBJECT UPPER AETNA LAKE DAM

15	16	423	62	81	12	27	44
16	33	944	144	82	12	26	46
17	67	1904	452	83	12	25	45
18	114	3305	1566	84	11	25	43
19	162	4642	3012	85	11	24	42
20	200	5443	4222	86	10	23	40
21	232	5668	4750	87	10	22	39
22	270	5464	5216	88	10	22	38
23	226	4975	5043	89	9	21	36
24	215	4341	4710	90	9	20	35
25	199	3679	4186	91	9	20	34
26	181	3059	3625	92	8	19	33
27	164	2503	3070	93	8	19	32
28	143	2024	2554	94	8	19	31
29	133	1621	2130	95	8	17	30
30	120	1337	1753	96	7	17	29
31	109	1075	1442	97	7	16	26
32	100	876	1191	98	7	16	27
33	92	707	1019	99	7	15	26
34	84	568	845	100	6	15	25
35	78	453	710	101	6	14	24
36	74	435	697	102	6	14	23
37	70	390	526	103	6	13	23
38	67	349	455	104	6	13	22
39	64	311	404	105	5	13	21
40	62	277	356	106	5	12	20
41	60	246	315	107	5	12	20
42	59	219	297	108	5	11	19
43	57	199	285	109	5	11	19
44	55	184	273	110	5	11	18
45	53	170	261	111	4	10	17
46	51	159	249	112	4	10	17
47	49	146	237	113	4	10	16
48	47	135	225	114	4	9	16
49	45	125	213	115	4	9	15
50	43	118	202	116	4	9	15
51	41	108	191	117	4	9	14
52	39	100	180	118	4	8	14
53	38	93	170	119	3	8	13
54	36	86	160	120	3	8	13
55	35	80	150	121	3	8	13
56	33	74	141	122	3	7	12
57	32	69	133	123	3	7	12
58	30	64	125	124	3	7	11
59	29	60	117	125	3	7	11
60	28	56	110	126	3	6	11
61	27	52	104	127	3	6	10
62	26	49	99	128	3	6	10
63	25	47	95	129	2	6	10
64	24	46	92	130	2	6	9
65	23	44	88	131	2	5	9
66	22	43	84	132	2	5	9
67	21	42	81	133	2	5	8
68	20	41	78	134	2	5	8
69	19	39	75	135	2	5	8
70	19	38	72	136	2	5	8
71	18	37	69	137	2	4	7
72	17	36	67	138	2	4	7
73	17	35	64	139	2	4	7
74	16	34	61	140	2	4	7
75	15	33	59	141	2	4	6
76	15	32	56	142	2	4	6
77	14	31	54	143	2	4	6
78	14	30	51	144	2	4	6
79	13	29	49	145	1	3	5
80	13	28	50	146	1	3	5

BY L.B. DATE _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO. 125 OF _____

CHKD. BY _____ DATE _____

MEPARD LAKES DAM INSPECTION

PROJECT C-246

SUBJECT UPPER ARINA LAKE

147	1.	3	5
148	1.	3	5
149	1.	3	5
150	1.	3	5

SUM 61211.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5016	2255	633	400.	61211
INCHED		3.51	4.27	4.31	4.31
AC-FT		1119	1056	1265.	1265
